

distribution and steam consumption is obtained at light loads than with simple throttle control.

Third, pure nozzle control, in which the nozzle plate is divided into a large number of compartments controlled by cam-operated tappet valves which come into operation successively.

It is usual to provide turbines with an emergency governor, in addition to the ordinary speed-regulating governor, for the purpose of assuring that steam is cut off completely in case the main governor should fail to hold the turbine to its normal speed.

The emergency governor should come into operation at a speed of 10 to 12 per cent above normal running speed, and, except in the smallest turbines, it is desirable that valves actuated by this governor should have no other function than to cut off the whole of the steam.

Overloads.—Where steam is admitted to the full blade or nozzle area at the first stage, as in the case of reaction turbines, any overload required has to be obtained by means of a by-pass which admits steam at full pressure to a lower stage of the turbine. This involves a more difficult casing construction, and has the drawback of subjecting a greater portion of the turbine to maximum pressure and temperature.

The overload valves on later turbines are automatically operated, and it is usually possible to obtain an overload of 25 per cent without any substantial fall in efficiency.

It is not now customary to run large steam turbines to atmosphere at all. The condensing plants are made sufficiently reliable to make the complete and sudden failure of the vacuum a very exceptional occurrence. In the case of smaller units it is still common practice to make provision for running to atmosphere, and in such cases it is usual to require the turbine to give an output of about 60 per cent of full load with the aid of the overload valve.

Glands.—Glands require to be fitted at the points at which the shaft enters and leaves the casing to prevent high-pressure steam escaping to atmosphere and air entering the condenser at the lower-pressure end. These glands are usually steam packed, and either consist of a series of carbon rings which bear lightly on the shaft and form a stuffing box, or

they take the form of a so-called labyrinth packing. The designs of the latter vary in detail, but are based on the principle of throttling the steam by means of a series of fine annular clearances, formed by corresponding metal rings let into the casing and shaft. The rings are usually made of brass, and are fitted with knife edges to allow for contact occurring without causing damage. In certain designs the glands take the form of a water seal.